DOCUMENT RESUME

ED 323 333 CE 055 671

AUTHOR Householder, Daniel L.; Boser, Richard A.
TITLE Development of Criteria and Procedures for Assessing the Effectiveness of the Change to Technology Teacher Education Programs.
PUB DATE Aug 90
NOTE 59p.; Report of a study partially funded by the Council for Technology Teacher Education.
PUB TYPE Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Check Lists; *Educational Change; *Evaluation Criteria; Evaluation Methods; *Industrial Arts; Postsecondary Education; *Preservice Teacher Education; Program Evaluation; Research Methodology; *Technology; Test Construction; Trade and Industrial Education

ABSTRACT

A study developed and validated measures that can be used to assess the effectiveness of the change from an industrial arts teacher education program to technology teacher education. A modified three-phase Delphi design was used to answer two questions: (1) Is the program technology teacher education (i.e., has the change progressed to the point where the program, taken as a whole, meets the criteria for inclusion in the category of technology teacher education, rather than industrial arts, vocational, or technical teacher education)? and (2) To what degree has the program moved effectively to accomplish the change to technology teacher education in terms of the criteria established by the accrediting agencies and by the consensus of experts consulted for this research? Initially, a panel of 22 technology education leaders was selected and asked to suggest criteria that could serve to indicate that the change to technology education had been accomplished effectively. The panel also proposed assessment procedures that could be used in the evaluation process. In the second phase, the criteria and procedures were compiled and submitted to the panel members for their rankings of the importance of the items and for their suggestions. From these responses, the assessment instrument, the Technology Teacher Education Checklist (TTEC), was developed, compared to guidelines of the International Technology Education Association, and revised. The TTEC should be useful to the faculty of a technology teacher education program or to an external evaluator in conducting assessment of the change to technology education. (Includes 34 references and a list of panelists, the questionnaires, and panelists' rankings, responses, and comments.) (KC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED323333

Development of Criteria and Procedures for Assessing the Effectiveness of the Change to Technology Teacher Education Programs

Daniel L. Householder

and

Richard A. Boser

Department of Industrial, Vocational and Technical Education

College of Education, Texas A&M University

College Station, Texas

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

D L Householder

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Report of a Study Partially Funded by the Council for Technology Teacher Education

August, 1990

CE 055 671

Executive Summary

The goal of this study was the development and validation of a set of measures that could be used to assess the effectiveness of the change from an industrial arts teacher education program to technology teacher education. Specifically two research questions were asked. The first question asks directly: Is the program technology teacher education? That is, has the change progressed to the point where the program, taken as a whole, meets the criteria for inclusion in the category of technology teacher education, rather than industrial arts teacher education, industrial teacher education, vocational teacher education, or technical teacher education? The second question is more general: To what degree has the program moved effectively to accomplish the change to technology teacher education in terms of the criteria established by the accrediting agencies and by the consensus of experts consulted for this research?

In order to answer these two questions, the researchers used a modified three-phase Delphi design. Initially, a panel of 22 technology education leaders was selected and asked to suggest criteria which could serve to indicate that the change to technology education had been accomplished effectively. The panel also proposed assessment procedures which could be used in the evaluation process.

In the second phase, the independently-suggested criteria and procedures were compiled and submitted to the panel members for their rankings of the importance of the items and for their editorial suggestions. From these responses, the researchers prepared the initial draft of the assessment instrument, the Technology Teacher Education Checklist (TTEC). The researchers compared the pooled consensus from the panelists with the ITEA/CTTE/NCATE guidelines (International Technology Education Association, 1987). Items selected for inclusion in the TTEC were (a) criteria which were highly ranked by the panel but not addressed by NCATE curriculum guidelines; (b) correlated to NCATE curriculum guidelines for technology teacher education and distinctly different from usual practices in industrial arts teacher education; and (c) considered essential to support the process of change in an organization.

In the third phase of the study, the draft of the TTEC was sent to the panelists for editorial suggestions and additional comments. The TTEC was then revised to reflect the suggestions and comments of the panel.

The Technology Teacher Education Checklist, which was the primary outcome of this research, should be useful to the faculty of a technology teacher education program or to an external evaluator in conducting formative or summative assessments of the change to technology education. While its use requires minimal duplication of the NCATE approval procedures, the items in TTEC focus upon the key indicators of effective change to technology teacher education. The TTEC might be especially useful in a review of a technology teacher education program, a year or two in advance of the preparation of a curriculum folio to be submitted for consideration for NCATE approval.

Table of Contents

Introduction 1

Background 2
Educational Program Evaluation 2
Program Evaluation in Teacher Education 6

Change and Program Implementation 7
A Model for Organizational Change 9
Summary 10

Methodology 10
Procedures 11
Selecting the Measurement Criteria and Procedures 13
Developing the Technology Teacher Education Checklist (TTEC) 13
Verification of the TTEC 14

Using the Instrument 16
Determining if the Innovation is In-Place 17
Force Field Analysis 17

Next Steps 18

References 19

List of Figures

1. Comparison of Context, Input, Process, and Product Evaluation 4

2. Barriers to Change in Teacher Education 8

List of Tables

1. Listing of Highly Ranked Criteria and Procedure Statements Sorted by Questionnaire Category 11

2. Technology Teacher Education Checklist 14

Appendices

A. Letter to ITEA and CTTE Officers Soliciting Nominations to the Panel 21

B. Listing of Panelists 22

C. Round I Letter and Open Ended Questionnaire to Panelists 24

D. Round II Letter and Questionnaire to Panelists 26

E. Ranked Listing of Criteria and Procedure Statements Sorted by Questionnaire Category 35

F. Panel Responses Compared with NCATE-Guidelines and Evidence of Compliance 40

G. Round III Letter to Panelists and Draft Technology Teacher Education Checklist 49

H. Comments on the Draft Technology Teacher Education Checklist 52

Introduction

During the summer of 1989, the Research Committee of the Council on Technology Teacher Education (CTTE) requested proposals for research that would investigate the infusion of technology education into existing teacher education programs. The RFP asked researchers to address the problem of assessing the effectiveness of the change from traditional industrial arts teacher education to technology teacher education. In October, 1989, a small grant was awarded by CTTE to provide partial support for this study.

As technology teacher education is implemented in the teacher education institutions in the United States, it is important to obtain an accurate assessment of the effectiveness of the innovation. Change in the teacher education curriculum may be assessed in a number of possible ways, each with several potential advantages. However, there is no generally accepted model for assessing the overall effectiveness of such a major change in technology teacher education. The goal of this study, therefore, was the development and verification of a set of measures that could be used to assess the effectiveness of the move to technology teacher education.

Specifically, the study sought answers to two research questions: "What measurements should be used to determine the effectiveness of the change?" and "How should these measurements be validated?" A modified Delphi design was used for the study, with a panel of 22 leaders in technology education who provided input at all phases of the research.

Three approaches identified through the review of literature were used in developing a framework for a set of measurements to assess the change to technology teacher education. First, the work by Hall and Horde (1987) on innovation configuration provided guidance in determining whether an innovation is actually in place. In the present case, the question became, "Has the implementation reached the stage where the program, taken as a whole, is technology teacher education, rather than industrial arts teacher education, industrial teacher education, vocational teacher education, or technical teacher education?"

Second, evaluation research by Ayers, Gephart, and Clark (1989), Stufflebeam and Shrinkfield (1985), and Provus (1971) framed the assessment question in terms of performance standards. This body of work suggested the research question, "To what degree has the program moved effectively to accomplish the change to technology teacher education in terms of the criteria established by the accrediting agencies and by the consensus of experts consulted for this research?" Third, Rogers (1983) identified concerns that affect innovations in organizations. From this perspective, the pertinent research question is, "To what stage has the implementation process progressed?"

The researchers sought to combine the advantages of the three approaches to assessment without duplicating the procedures required for accreditation. The criteria and procedures which were developed as a part of the study are described in this report. These criteria and procedures are available for departmental faculties to use in evaluating the effectiveness of change in their individual institutional settings. In this application, the procedures should be particularly useful for self-studies one to three years in advance of the preparation of a folio for ITEA/CTTE/NCATE accreditation. In addition, the criteria and procedures could be used in comparative studies of the change to technology education across institutional boundaries.

Background

The literature relevant to the assessment of change and program implementation may be categorized into three areas: (a) educational program evaluation; (b) program evaluation in higher education, specifically in teacher education; and (c) change and program implementation in teacher education programs. Studies in each of these areas were reviewed to establish the research base for the development of the formative evaluation system for technology teacher education programs.

Educational Program Evaluation

Numerous evaluation approaches may be used to gather data on program effectiveness. In a literature search for an applicable model for the evaluation of teacher education programs, Ayers, Gephart, and Clark (1989) reported "approximately 40 references to evaluation models" (p. 14). Stufflebeam and Webster (1980) identified and assessed 13 alternative evaluation approaches in terms of their adherence to the definition: "an educational evaluation study is one that is designed and conducted to assist some audience to judge and improve the worth of some educational object" (p. 6). Their analysis resulted in three categories of evaluation studies: (a) politically oriented, or pseudo evaluations; (b) question oriented, or quasi-evaluations; and (c) values oriented, or true evaluations. Stufflebeam and Webster addressed the strengths and weaknesses inherent in each evaluation approach in order to provide evaluators with a variety of frameworks for conducting evaluation studies.

Curriculum texts such as those by Armstrong (1989) and Glathorn (1988) typically discuss the major educational evaluation models. Additional discussion of specific models is readily available (Stufflebeam and Shrinkfield, 1985; Madaus, Scriven, & Stufflebeam, 1983; Guba & Lincoln, 1981; Stufflebeam & Webster, 1980; Popham, 1975). However, no detailed analysis of these evaluation models is included in this report. As Popham (1975) noted, comparing evaluation approaches in order to select the best model is usually a fruitless endeavor. Popham stated:

> Instead of engaging in a game of "sames and differents," the educational evaluator should become sufficiently conversant with the available models of evaluation to decide which, if any to employ. Often, a more eclectic approach will be adopted whereby one selectively draws from the several available models those procedures or constructs that appear most helpful. (p. 21)

Cronbach (1982) echoed this need for eclecticism by noting that "the [evaluation] design must be chosen afresh in each new undertaking, and the choices to be made are almost innumerable" (p. 1). Indeed, an eclectic approach seemed most appropriate for the formative evaluation of the change to technology teacher education, given the goals of the study and the assumptions under which it was conducted. The review of the evaluation literature identified two approaches that could be combined to develop appropriate instrumentation and procedures. These were the Context, Input, Process, and Product (CIPP) Model originated by Stufflebeam et al. (1971), and the Discrepancy Model proposed by Provus (1971). These models have many commonalities. Both models:

1. Were conceptualized and developed in the late 1960s in response to the need to evaluate projects funded through the Elementary and Secondary Education Act (ESEA) of 1965.

2. Represented efforts to broaden the view of educational evaluation to include more than an assessment of the terminal objectives.

3. Emphasized the systems view of the education by stressing the relationship between context, inputs, processes, and products.

4. Emphasized the importance of collecting information on key developmental factors to aid decision-makers in assessing program progress at a given point (Brinkerhoff, Brethower, Hluchyj, and Nowakowski, 1983).

5. Were concerned with the developmental aspects of program design and implementation, and recommended close collaboration with program developers.

6. Have been used in a variety of evaluation environments (Roth, 1978; Provus, 1971; and Stufflebeam, et al., 1971), though they are not specifically designed for the evaluation of teacher education programs.

The CIPP Model. Bjorkquist and Householder (1990) noted that "programs in which goals are accomplished are usually considered to be effective" (p. 69). In an overview and assessment of evaluation studies, Stufflebeam and Webster (1980) stated that the objectives-based view of program evaluation "has been the most prevalent type used in the name of educational evaluation" (p. 8). Indeed, prior to the ESEA, educational evaluation had focused upon "the determination of the degree to which an instructional program's goals were achieved" (Popham, 1975, p. 22). However, a group lead by Stufflebeam purposed an evaluation process that focused upon program improvement by evaluating virtually all aspects of the educational program. Stufflebeam (1983) stated:

> Fundamentally, the use of the CIPP Model is intended to promote growth and to help the responsible leadership and staff of an institution systematically to obtain and use feedback so as to excel in meeting important needs, or at least, to do the best they can with the available resources. (Stufflebeam, 1983, p. 118).

In short, the CIPP Model placed a premium on information that can be used proactively to improve a program. A summary of the objectives and methods used by the four types of evaluation that comprise the CIPP Model is presented in Figure 1.

	Context Evaluation	Input Evaluation
Objective	To define the institutional context, to identify the target population and assess their needs, to identify opportunities for addressing the needs, to diagnose problems underlying the needs, and to judge whether proposed objectives are sufficiently responsive to the assessed needs.	To identify and assess system capabilities, alternative program strategies, procedural designs for implementing the strategies, budget, and schedules.
Method	By using such methods as systems analysis, survey, document review, hearings, interviews, diagnostic tests, and the Delphi technique.	By inventorying and analyzing available human and material resources, solution strategies, and procedural designs for relevance, feasibility and economy; and by using such methods as literature search, visits to exemplary programs, advocate teams, and pilot trails.
	Process Evaluation	**Product Evaluation**
Objective	To identify or predict, in process, defects in the procedural design or its implementation, to provide information for the pre-programmed decisions, and to record and judge procedural events and activities.	To collect descriptions and judgments of outcomes and to relate them to objectives and to context, input, and process information; and to interpret their worth and merit.
Method	By monitoring the activity's potential procedural barriers and remaining alert to unanticipated ones, by obtaining specified information for programmed decisions, by describing the actual process, and by continually interacting with and observing the activities of project staff.	By defining operationally and measuring outcome criteria, by collecting judgments of outcomes from stakeholders, and by performing both qualitative and quantitative analyses.

Figure 1. Comparison of Context, Input, Process, and Product Evaluation

Adapted from Stufflebeam (1983), *CIPP Model for Program Evaluation.*

Discrepancy Model. The Discrepancy Model was developed by Provus to evaluate ESEA funded programs implemented in the Pittsburgh public schools. The model was developed to be put in place as the new programs were designed and implemented. A systems approach was used to determine whether program performance met accepted program standards. Provus (1971) conceptualized a three-step process of program evaluation:

1. Defining program standards.

2. Determining whether a discrepancy exists between some aspect of program performance and the standards governing that aspect of the program.

3. Using discrepancy information either to change performance or to change program standards. (p. 183)

According to Provus, this operational definition of program evaluation leads to four possible alternatives: (a) the program can be terminated, (b) the program can proceed unaltered, (c) the performance of the program can be altered, or (d) the standards governing the program can be altered (Popham, 1975).

The Discrepancy Model has five stages: (a) design; (b) installation; (c) process; (d) product; and (e) program comparison. Provus (1971) noted that, "at each of these stages a comparison is made between reality and some standard or standards" (p. 46). The first four stages are developmental in nature and designed to evaluate a single program. The fifth stage, which Provus designated as optional, provides information for making comparisons with alternative programs. Each of the five stages is reviewed below.

1. Design. This stage is similar in intent to the first two stages of the CIPP Model. The goal of the evaluator is to document the nature of the program by including information from a variety of constituents about: (a) goals and objectives of the program; (b) the clients the program is to serve; (c) the resources available; and (d) instructional strategies that will promote the goals and objectives.

2. Installation. Using the design information compiled during the first stage as standards, the evaluator compares the level of fidelity of the installed program with the design plan. The information gathered can then be used to adjust the implementation procedure.

3. Process. At this stage the evaluator asks whether the program is achieving its enabling objectives. Interim measures of the progress of the program in meeting objectives are compared to the design plan. Again, four options are available to decision-makers: (a) alter performance; (b) alter standards; (c) termination; or (d) proceed unaltered.

4. Product. At this point, the focus shifts to the assessment of terminal objectives. The post-instructional performance of learners is compared with program design standards to detect discrepancies.

5. Program comparison. This optional fifth stage uses across-program comparisons to explore whether the program is worth the expense. A cost-benefit analysis is suggested for this comparison.

Merging the evaluation models. With the commonalities of the two models previously stated and the thoroughness of the CIPP Model reviewed, one might well ask why the two models should be merged. The answer lies in the complementing strengths of the two models. CIPP, with its use of both quantitative and qualitative procedures and its emphasis on proactive evaluation, provides an overarching

evaluation model. Because of its thoroughness, it is also extremely expensive and time consuming. As Stufflebeam and Webster (1980) noted, values-oriented studies, such as CIPP, aimed at assessing the overall merit or worth of a program are overly ambitious "for it is virtually impossible to assess the true worth of any object" (p. 18). However, the CIPP model provides an excellent framework for approaching the multitude of possible variables in program evaluation.

What does the discrepancy evaluation model add to this customized assessment approach? Stufflebeam and Webster (1980) stated that question-oriented studies that focus on program objectives or standards "are frequently superior to true evaluation studies in the efficiency of methodology and technical adequacy of information employed" (p. 18). In particular, the discrepancy model championed by Provus adds three useful constructs to the evaluation process:

1. The broadening of the evaluation procedure to include the possibility of altering the standards to conform with reality. In light of the current emphasis on standards external to the program, such as NCATE criteria, this approach seemed particularly appropriate.

2. The emphasis upon high-fidelity implementation addressed major concerns in the change process.

3. The emphasis upon problem solving solutions to program performance alteration appeared to be consistent with the espoused philosophy of technology education.

Since technology teacher education programs are still largely in the implementation stage, assessments of their effectiveness could most profitably focus on discrepancies between the performances and standards that are concerned with the inputs and the processes of the technology teacher education programs. Taken together, it seems reasonable to consider an evaluation approach that focuses on input and process evaluation components as Stufflebeam uses the terms by comparing actual performance with defined standards.

Program Evaluation in Teacher Education

Few studies have related specific program evaluation approaches to the assessment of teacher education programs. Galluzzo (1983) used the CIPP model and standardized teacher examinations in an evaluation of a teacher education program and Roth (1978) developed a handbook on the use of the CIPP model for evaluating teacher education programs. Brunkhorst (1988) proposed a Multicomponent Evaluation Model (MEM) that would provide continuous and comprehensive evaluation of teacher education programs. In an approach similar to the CIPP model, MEM uses a holistic approach to assess the strengths and weaknesses of each component of the teacher education program. MEM integrates a periodic review of the program structure with on-going process monitoring and a systematic review of program outcomes.

Perhaps the dearth of references in the literature to specific evaluation approaches used in teacher education programs is the result of the emphasis placed on the accreditation of those programs. Accreditation procedures require that teacher education institutions periodically undertake systematic formative and summative evaluations. Taking this reality into consideration, Ayers, Gephart, and Clark (1989) proposed the Accreditation Plus Model that integrates the accreditation process and existing evaluation approaches. While focusing on the National Council for Accreditation of Teacher Education (NCATE) standards and criteria for compliance, the model suggests a process that is "active, continual, and formative" (p. 16). The authors stated:

> This more active evaluation stance should produce a more useful and higher quality evaluation. This in turn may cause the institution to reach out for information beyond the usual accreditation information.
>
> At this point the education unit has a decision to make. If the education unit is satisfied with the information generated via the accreditation process, then that documents compliance. The design and planning work is done. What is left is implementation and monitoring. The Accreditation core of the model has been accomplished.
>
> If, however, additional evaluative questions exist and, if the educational unit wants those items informed, "use-tailored evaluation" procedures will be planned and implemented. This is the place for the Plus aspect of the Accreditation Plus Model. . . . The call here is for an informed eclecticism in the assembly of evaluational procedures that will meet the additional needs. (p. 17)

The Accreditation Plus Model seems to be a logical extension of an already required practice. While this model was designed to be used for the evaluation of professional educational units, the process seems adaptable to the more specific evaluation concerns of technology teacher education programs.

Change and Program Implementation

Gee and Tyler (1976) suggested that "reasonable people will assume moderate risk for great benefits, small risks for moderate benefits, and no risk for no benefit" (p. 2). While this statement makes explicit the personal nature of the change process, organizational characteristics are obviously also important factors. An organization, as defined by Rogers (1983), is "a stable system of individuals who work together to achieve common goals through a hierarchy of ranks and a division of labor" (p. 348). The concept of a stable system underlies the potential difficulties of introducing and sustaining an innovation in an organizational environment.

Hopkins (1984) argued that the nature of the educational organization itself is a major impediment to change. He noted that in spite of considerable external pressure for change in teacher education, there were few observable differences in the routines of professors and students. Hopkins made the provocative suggestion that "teacher training institutions as organizations appear unable effectively to manage self-initiated change" (p. 37). Giacquinta (1980), even less charitable, suggested that schools of education find that "change is a necessary, often bitter pill taken for the sake of survival" (Hopkins, 1984, p. 43). These opinions seem to be shared by several state legislatures which have recently mandated changes in teacher education requirements and practices.

In a study of Canadian teacher training institutions, Hopkins (1982) identified a lengthy list of barriers to change. The barriers were categorized as either: (a) systemic; (b) organizational; or (c) individual. Also, barriers were classified either as real or perceived. In distinguishing between real and perceived barriers, Hopkins stated, "as the research progressed, it became obvious that a number of the barriers to change were perceived rather than actual, or . . . were a reality that had little empirical support" (p. 20). Hopkins' listing of types of barriers is presented in Figure 2.

	Organizational Change	Perceived Barriers
Systemic	- Economic factors - Political pressure (government) - Vulnerability (environmental constraints) - Central university administration - Tradition	- Inertia - Future uncertainty - Bureaucratic myth
Organizational	- Lack of clear mission (goal variability) - Incongruent reward system - Poor communication - Absence of linking structures (low interdependence) - Autonomous pluralism (professorial independence) - Complexity of decision-making process - Inadequate implementation - Discontinuity of personnel (academic year, sabbaticals, retirement) - Inertia (acceptance of the status quo)	- Top down approach to change - Teachers' college legacy - Recent history of change
Individual	- Poor leadership - Tenure system - Pluralism of roles - Socialization into a discipline (identification with discipline as opposed to institution) - Incompetence - Innovation fatigue	- Emotional resistance to change - Too busy (high status of busyness ethos) - Tendency to externalize (blame others for the state of inertia)

Figure 2. Barriers to Change in Teacher Education

Adapted from D. Hopkins (1982), *The Problem of Change in Canadian Teacher Education.*

Understanding the barriers to change is critical to the success of an innovation. An accurate analysis of the barriers to change provides a starting point for attacking the problem. As Sarason (1971) noted, "recognizing the adversary gives one a basis for asserting that the problem is neither hopeless nor insoluble" (p. 236).

A Model for Organizational Change

In a review of the literature on innovation in higher education, Dill and Friedman (1979) observed that "it is voluminous . . . [and] overwhelmingly descriptive" (p. 412). The authors described four frameworks that addressed change in higher education: (a) complex organization model; (b) conflict model; (c) diffusion model; and (d) planned change model. Dill and Friedman speculated that a more powerful eclectic model may emerge from a clear understanding of each of the frameworks analyzed. Moreover, the authors suggested that the explanatory power of an amalgamated model would be enhanced if the strengths of the diffusion model were incorporated into the research design and "by taking time and the extensiveness of adoption into explicit account" (p. 433).

A model of the innovation-decision process in an organization, developed by Rogers (1983), addresses these factors from another perspective. The Rogers model was synthesized from the diffusion research tradition and focuses on the process of adoption, implementation, and the incorporation of the innovation into the organization. The five steps in the model are divided into two stages: initiation and implementation.

Initiation Stage. During the initiation stage, organizational activities center around the information-gathering, conceptualizing, and planning that is required to make the decision to change. The two steps included at this stage are: (a) agenda setting, where the initial idea search occurs and the motivation to change is generated; and (b) matching, where organizational problems and possible solutions are analyzed for compatibility.

The initiation stage is essentially a problem solving exercise. As the organization becomes cognizant of a performance shortfall, it initiates a search of the environment for possible solutions to the problem. For example, industrial arts programs were generally faced with declining enrollments. At the same time, many studies cited the need for students to possess increased scientific and technological literacy. In response, the field started to focus on technology education as an emergent solution to both problems.

Implementation Stage. The second stage, implementation, begins after the decision to make the change has been made by the organization. This stage includes the decisions, actions, and procedures involved in putting an innovation into regular use. The implementation stage includes three steps: (a) redefining/restructuring the innovation and the organization to accommodate the change; (b) clarifying the innovation as it is put into regular use; and ultimately (c) routinizing or institutionalizing the change as an integral part of the ongoing activities of the organization.

According to Rogers (1983) each step is "characterized by a particular range of events, actions, and decisions" (p. 362). Further, the latter steps cannot occur until the issues in the earlier steps have been resolved. Citing the work of Pelz (1982) as a source of support for the model, Rogers noted that innovations imported into an organization "usually occur in the time-order sequence" (p. 366). However, innovations that originated within an organization are not characterized by a similarly clear pattern of adoption. Since technology teacher education programs are currently changing in an attempt to meet largely external innovations (NCATE

accreditation standards and state certification requirements), it appears that the time-order sequence is expected to apply. The linear nature of the innovation-decision model highlights the need to nurture the change to technology teacher education throughout the stages of the entire change process.

Summary

In light of the review of literature and the specific goals of this research effort, the decision was made to develop an evaluation design incorporating an eclectic mix of program evaluation approaches, the NCATE accreditation process, and descriptions of the process of change as that process may be expected to occur in teacher education organizations. Stufflebeam's CIPP Model provided an overall framework from which to assess the effectiveness of change to technology teacher education. Provus's Discrepancy Model added the possibility of adjusting the measurement standards to conform to program performance reality. And, because accreditation is an overarching evaluation concern for teacher education, the Accreditation Plus Model suggested a way of integrating program evaluation and accreditation. Further, because technology teacher education programs are presently in the early implementation stage, measures that reflect the process of change seemed to be appropriate for inclusion.

Methodology

The goal of this study was the development and validation of a set of measures that could be used by teacher education faculty and/or by external evaluators to assess the effectiveness of the change from an industrial arts teacher education program to a technology teacher education program during the implementation of that change. Although a full scale formative evaluation would be required for the most accurate assessment, several delimitations apply to the formative evaluation design developed by this project:

1. The time required for on-site data collection by the external evaluator(s) should not exceed two observer-days.

2. With the exception of interviews and classroom and laboratory observation sessions, the data gathering should not require additional faculty time.

3. Existing data should be used whenever possible.

4. Data gathering should not seriously disrupt on-going instructional activities.

In order to design a formative evaluation system which could be employed within these delimitations, three assumptions were necessary. The first assumption accepted the validity of the philosophy, mission, and goals of technology teacher education as stated by International Technology Education Association (ITEA) (1985) and delineated in the criteria of the National Council for Accreditation of Teacher Education (NCATE) (1987). Second, it was assumed that the technology teacher education program has applied for or is working toward NCATE approval. Third, it was assumed that the rationale and priorities of the technology teacher education program are congruent with the needs of its constituencies.

Within these assumptions and delimitations, two questions were asked. First, as existing teacher education programs are modified to prepare technology education teachers, what measurements should be used to determine the effectiveness of the change? Second, how should these measurements be validated?

Procedures

To answer the first question, the researchers used a modified Delphi design. Nominations of leading practitioners and advocates in technology education who might serve as Delphi panelists were solicited from officers of CTTE and ITEA (Appendix A). This process resulted in the selection of a panel comprised of the 22 individuals who were recommended by at least two of the CTTE or ITEA officers (Appendix B).

An open-ended questionnaire was sent to the panel members. Panelists were asked to suggest criteria for evaluating the effectiveness of the change from industrial arts teacher education to technology teacher education programs. Space was provided on the questionnaire to enter 10 criteria, but the panelists were encouraged to list as many criteria as they felt were necessary (Appendix C).

Panelists were also asked to suggest procedures for evaluating the effectiveness of the change from industrial arts teacher education to technology teacher education programs. Five response blanks were provided, but panelists were encouraged to include as many evaluation procedures as they thought appropriate.

Fourteen panelists returned the first round questionnaire. Initial responses were tabulated, duplications were eliminated, and similar suggestions were combined. These procedures resulted in a list of 58 criteria and 33 procedures for evaluating the effectiveness of the change to technology teacher education. The criteria were sorted into four categories: (a) the technology teacher education program, (b) faculty members, (c) student skills, and (d) capabilities of graduates.

The second round questionnaire asked the 22 panelists to rate the importance of the 58 criteria and 33 procedures on a scale which ranged from 0 to 10. The instructions defined a rating of 0 as a recommendation that the criterion or procedure be dropped. A rating of 10 meant that the criterion or procedure was considered to be absolutely vital to the assessment of the effectiveness of the change to technology teacher education. Panelists were asked to offer editorial suggestions on the statements of criteria and procedures and also to suggest additional criteria and procedures (and to rate any additional statements) (Appendix D).

Eighteen of the 22 questionnaires were returned promptly. The 18 responses were tabulated and the mean rating of importance for each item was calculated. The statements of criteria and procedures were then listed in order of their mean rating of importance. The ranked listings for each criterion with a mean value greater than 9.0 on the 10 point scale are included in Table 1. The complete ranked listings are reproduced in Appendix E.

Table 1

Listing of Highly Ranked Criteria and Procedure Statements Sorted by Questionnaire Category.

Mean	**Technology teacher education program**
9.55	Laboratory instruction provides opportunities for students to reinforce abstract concepts with concrete experiences.
9.50	Instructional strategies emphasize conceptual understanding and problem solving.

Table 1 Continued

9.23	Professional studies component emphasizes the study of technology, including social-cultural affects and consequences.
9.22	Laboratories facilitate the learning of broad based technological concepts.
9.22	Instruction incorporates current technological activities.
9.17	Philosophy, mission statement, goals and curriculum emphasize technological skills as opposed to technical skills.
9.17	Social-cultural impacts of technology are emphasized.
9.12	Field experiences are technology centered.
9.05	Problem solving and decision making abilities are emphasized.
9.00	Curricula are based on recent research findings.

Faculty Members

9.50	Display a positive attitude toward the technology teacher education curriculum.
9.22	Participate in planned professional development activities to update their knowledge and skills.
9.05	Communicate their understanding of the meaning and implications of technology education both within and outside the classroom.

Students are expected to:

9.78	Be people oriented.
9.44	Be future oriented.
9.39	Demonstrate the ability to teach problem solving techniques.
9.33	Effectively plan and implement technology education in grades 5-12.
9.28	Develop and implement curriculum material that reflect a broad technological system area.
9.28	Demonstrate an awareness of societies reliance on technological systems.
9.22	Plan and implement teaching-learning activities.
9.17	Use a vocabulary that reflects the concepts of technology education.
9.11	Apply current instructional theory.
9.06	Formulate appropriate objectives.
9.05	Be open to change and willing to initiate change.
9.05	Consider global perspectives in technology education.

Table 1 Continued

9.00 Demonstrate a basic understanding of tools, machines and process and their applications in manufacturing, construction, communication, and transportation.

Graduates of the technology teacher education program:

9.78 Employ a philosophy which reflects a technological base.

9.61 Teach concepts and use teaching techniques that are technology based.

Procedure Statements

9.50 Examine the curriculum to determine if the philosophy, definition, mission statement, goals and objectives, course content, and learning experience reflect technology education.

9.22 Analyze the courses required in the program, the content contained in each of the courses, teaching strategies and methods, assignments, tests, and student field experience to determine if they reflect technology education.

Several weeks after the data analysis was completed, three additional completed questionnaires were received. Inspection of these questionnaires indicated that the ratings of item importance were essentially comparable to the results of the data analysis. Since the preparation of the instrument was nearly completed at that time, the data from the three late respondents were not included in the criteria and procedure rankings.

Selecting the Measurement Criteria and Procedures

One of the major outcomes of this research effort was the identification of a high degree of correspondence between the criteria for assessment of technology teacher education programs suggested by the panel of experts in this study and the NCATE approved curriculum guidelines as specified in *Basic Program in Technology Education* (1987). Most of the remaining criteria suggested by the panel corresponded closely to the guidelines from the *Standards, Procedures, and Policies for the Accreditation of Professional Education Units* (NCATE, 1987). The criteria suggested by the panel of experts in this study and the NCATE curriculum guideline(s) most closely associated with the respective suggested criteria are listed in Appendix F.

Developing the Technology Teacher Education Checklist (TTEC)

An initial review of the listing of criteria and procedures identified by the panelists in this research suggested many parallels to the NCATE accreditation process. The primary intent of this investigation was not to duplicate the NCATE assessment process, but to identify essential elements in the implementation of technology teacher education that would serve as key indicators of the effectiveness of the change from industrial arts teacher education. In order to concentrate the assessment effort, therefore, items were selected for inclusion in the measurement instrument if they were:

1. Highly ranked within their criteria category but not addressed by NCATE curriculum guidelines;

2. Correlated to NCATE curriculum guidelines for technology teacher education and distinctly different from usual practices in industrial arts teacher education; or

3. Considered to be essential to support the process of organizational change.

The first draft of the TTEC did not include measurements of program outcome, such as performance of program graduates. These items were excluded from the measurement instrument since technology teacher education is in the implementation phase, a stage when Hall and Hord (1987) noted that "interpreting any outcome data is extremely risky" (p. 343). The draft Technology Teacher Education Checklist is reproduced in Appendix G.

Verification of the TTEC

In order to verify the measures selected for inclusion in the checklist, a draft of the TTEC was sent to the panel for editorial suggestions and additional comments. Sixteen of the twenty-two panelists responded. Most respondents suggested editorial revisions or made other comments. Careful consideration was given to these suggestions as revisions were made in the TTEC. One of the major changes as a result of the verification process was the inclusion of several program outcome measures. Panelists strongly recommended that a number of outcome measures which were initially highly-ranked should be included in the TTEC, despite the difficulties in interpreting output data. Similarly, involvement in a TECA chapter was included in the revisions of the TTEC in response to suggestions from panelists. The TTEC, revised to incorporate suggestions from panelists, is reproduced in Table 2 below. Suggestions and the comments received from the panel about the draft TTEC are included in Appendix H.

Table 2

Technology Teacher Education Checklist.

A. Examine the catalog, a sample of curriculum documents, and a sample of course syllabi to verify the degree to which:

1. The philosophy, mission statement, and goals and objectives of the program reflect the definition(s) of technology education suggested by ITEA, CTTE, and relevant groups in the state/province.

2. Study is required in technological systems such as communication, production (construction and manufacturing), transportation, and biotechnology.

3. Courses in mathematics, science, and computing science are required.

4. Required full-time student teaching and early field experiences are conducted in an exemplary technology education setting.

5. Required reading lists provide comprehensive coverage of technology and technology education.

6. Learning activities and experiences are representative of technology education.

Table 2 Continued

B. Interview the department head with regard to the change to technology teacher education to discern the degree to which:

1. Funding is adequate to support the current technology teacher education program and plans are in place for periodic replacement and upgrading of facilities and equipment.

2. Faculty and staff allocations are adequate to serve student enrollments in technology teacher education.

3. The written departmental plan for faculty professional development and technological updating is adequate to prepare faculty members for contemporary technology teacher education.

4. Enrollments in the major are adequate, stable, or increasing.

5. The written departmental implementation plan for technology teacher education addresses the process of organizational change.

6. Faculty are committed to the philosophy and objectives of technology education.

C. Interview faculty members and review recent annual reports, biodata information, faculty publications, copies of presentations, and manuscripts being considered for publication to verify whether:

1. Faculty are writing scholarly papers, developing instructional materials, and giving presentations about technology education.

2. Current faculty research and service activities are directed toward topics and issues in technology education.

3. Faculty are actively involved in professional organizations in technology education.

D. Observe professional and technical classes to discern the degree to which:

1. Instructional methods emphasize technological problem solving and decision-making.

2. Instructional materials reflect contemporary technology.

3. Major elements of technology education (e.g., systems, environmental and social impacts, and the applications of technological devices) are emphasized in the course activities.

E. Inspect laboratory facilities to ascertain the degree to which:

1. Laboratories are adequate for effective instruction.

2. Equipment and space provide students adequate opportunities for experiences in state-of-the-art applications of technology (e.g., CAD/CAM, CIM, robotics, desk-top publishing, lasers, table-top technology, hydroponics).

Table 2 Continued

F. Interview students, and examine student logs and required student work to discern whether:

   1. The elements of technology education are understood and integrated into their total philosophy of education.

   2. They are active in a TECA chapter.

   3. The problem solving process and decision-making rationale are incorporated into grading.

   4. Environmental consequences and social-cultural effects of technology are reflected in student activities.

G. Interview chairs of related departments and administrators (dean, provost, or president) to ascertain the degree of philosophical support that is provided for technology education.

H. Listen to conversations and discussions and observe student activity to discern the degree to which:

   1. The terminology used by faculty and students reflects technology and technology education.

   2. Faculty and students appear to be enthusiastic about technology education.

I. Interview principals who have experience with student teachers and graduates of the technology education program to discern whether the program prepares professionals to:

   1. Plan and implement technology education.

   2. Use problem solving strategies.

   3. Apply current instructional theory.

Using the Instrument

Jordan (1989) began a discussion of evaluation and change by reminding practitioners that:

> One of the axioms of measurement is that assessment is not an end in itself. We evaluate because we wish to know the current state of affairs, but we wish to do that in order to make improvements. Exactly how we wish to improve depends on what we discover. In theory, the process is circular and unending. That is, we should assess and make improvements and then assess the improvements. (p. 147).

With this interaction between evaluation and change in mind, there are several possible ways of using the instrument developed through this research. Perhaps the simplest use would be for an internal or external evaluator to use the instrument as

a checklist of what has been accomplished and what is in progress (or still to be initiated). Two more complex uses may include determining if the innovation is in place and using force field analysis to determine sources of resistance.

Determining if the Innovation is In-Place

Hord, Rutherford, Huling-Austin and Hall (1987) proposed that before assessing program outcomes it is first necessary to determine that the innovation is in fact in place. They indicated two ways of making that determination: (a) first, the level of fidelity of the actual implementation of the innovation can be compared with the intended innovation by determining the innovation configuration, and (b) second, the actual levels of use can be determined. According to the authors:

> Innovation Configuration (IC) represents the patterns of innovation use that result when different teachers put innovations into operation in their classrooms. In the course of our early work, we noted that individual teachers (and professors) used different parts of an innovation in different ways. When these parts were put together, a number of patterns emerged, each characterizing a different use of the innovation. We called these patterns Innovation Configurations. (p. 13)

Hord et al. (1987) proposed that each innovation has essential and related components. The essential components cannot be changed without undermining the nature of the innovation itself. The related concepts allow for local flexibility and, while varied, are still faithful to the innovation design. Hord et al. suggested that assessment of fidelity can be made by developing an IC checklist that outlines ideal, acceptable, and unacceptable variations of the innovation. In technology teacher education programs, many of the criteria identified through this research may serve as the "essential" components.

The second measure proposed by Hord et al. (1987) to determine whether or not the innovation is actually in place is an assessment of the six levels of use. These levels range from Level of Use 0, nonuse, to Level of Use VI, renewal, where the "user reevaluates the quality of use of the innovation, seeks major modifications of or alternatives to, present innovation to achieve increased impact on clients, examines new developments in the field, and explores new goals for self and the organization" (p. 55). By using the TTEC to identify the essential components of the change to technology teacher education, an assessment of levels of use from the perspective of the faculty may be an important step in measuring the effectiveness of the change and planning further intervention strategies.

Force Field Analysis

Lewin (1951), the originator of field psychology, proposed that change is the result of competition between driving and resisting forces (Daft, 1988). Lewin's conceptualization has been adapted to describe the dynamics of a number of management situations in organizational change. Daft stated that:

> To implement a change, management should analyze the change forces. By selectively removing forces that restrain change the driving forces will be strong enough to enable implementation. . . . As restraining forces are reduced or removed, behavior will shift to incorporate the desired changes. (p. 313)

Miller (1987) suggested that force field analysis could be used to nurture a climate receptive to innovation and creativity. Miller stated:

> The primary function of the force field in idea generation is to present three different stimuli for thinking of new options or solutions. Because the field

represents a kind of tug-of-war, there are three ways to move the center line in the direction of the more desirable future:

1. Strengthen an already present positive force.
2. Weaken an already present negative force.
3. Add a new positive force. (p. 73)

If these two ideas are taken together, a picture emerges of how force field analysis and the instrument designed through this research could be applied to the transition from industrial arts teacher education to technology teacher education. First, each criterion could be assessed to determine its relative strength as a driving force for change. Second, forces unique to the particular implementation may be identified and dealt with. Third, the information generated through the assessment could be used to strengthen the implementation procedures. In this way, the instrument may serve as a game plan for implementation and continued assessment of the change.

Next Steps

The Technology Teacher Education Checklist, the primary product of this study, now appears to be ready for field testing and validation. The researchers plan to conduct field testing during the 1990-91 academic year by applying the TTEC criteria and procedures in a sample of technology teacher education programs. Results of the TTEC field testing will be validated by comparisons with other measures of program quality.

References

Ayers, J. B., Gephart, W. J., & Clark, P. A. (1989). The accreditation plus model. In J. B. Ayers and M. F. Berney (Eds.) *A practical guide to teacher education evaluation* (pp. 13-22). Boston: Kluwer-Nijhoff.

Armstrong, D. G. (1989). *Developing and documenting the curriculum.* Boston: Allyn and Bacon.

Bjorkquist, D. C., & Householder, D. L. (1990). Reaction to reform: Research implications for industrial teacher education. *Journal of Industrial Teacher Education, 27*(2), 61-74.

Brinkerhoff, R. O., Brethower, D. M., Hluchyj, T., & Nowakowski, J. R. (1983). *Program evaluation: A practitioner's guide for trainers and educators.* Boston: Kluwer-Nijhoff.

Brunkhorst, G. R. (1988). The development of a multicomponent evaluation model for undergraduate teacher education programs. *Dissertation Abstracts International, 49,* 07A, 1769. (Publication No. AAC8816638)

Cronbach, L. J. (1982). *Designing evaluations of educational and social programs.* San Francisco: Jossey-Bass.

Daft, R. L. (1988). *Management.* New York: Dryden Press.

Dill, D. D., & Friedman, C. P. (1979). An analysis of frameworks for research on innovation and change in higher education. *Review of Educational Research, 57*(3), 411-435.

Gee, E. A. & Tyler, C. (1976). *Managing innovation.* New York: John Wiley & Sons.

Giacquinta, J. B. (1980). Organizational change in schools of education: A review of several models and an agenda of research. In D. E. Griffiths & D. J. McCarthy (Eds.), *The dilemma of the deanship.* Danville, IL: Interstate.

Glathorn, A. A. (1988). *Curriculum leadership.* Glenview, IL: Scott, Foresman and Company.

Galluzzo, G. R. (1983). *An evaluation of a teacher education program.* A paper presented at the Annual Meeting of the American Educational Research Association, Montreal, Canada. (ERIC Document Service ED 229373)

Guba, E. G., & Lincoln, Y. S. (1981). *Effective evaluation.* San Francisco: Jossey-Bass.

Hall, G. E., & Hord, S. M. (1987). *Change in schools: Facilitating the process.* Albany: State University of New York Press.

Hopkins, D. (1982). The problem of change in Canadian teacher education. *The Canadian Journal of Higher Education, 12*(2), 17-31.

Hopkins, D. (1984). Change and the organisational character of teacher education. *Studies in Higher Education, 9*(1), 37-45.

Hord, S. M., Rutherford, W. L., Huling-Austin, L., & Hall, G. E. (1987). *Taking charge of change.* Alexandria, VA: Association for Supervision and Curriculum Development.

International Technology Education Association. (1985). *Technology education: A perspective on implementation.* Reston, VA: Author.

International Technology Education Association/Council on Technology Teacher Education. (1987). *NCATE-approved curriculum guidelines: Basic program in technology education.* Reston, VA: Author.

Jordan, T. E. (1989). *Measurement and evaluation in higher education: Issues and illustrations.* Philadelphia: Falmer Press.

Lewin, K. (1951). *Field theory in social science.* New York: Harper.

Madaus, G. F., Scriven, M. S., & Stufflebeam, D. L. (1983). *Evaluation models: Viewpoints on educational and human services evaluation.* Boston: Kluwer-Nijhoff.

Miller, W. C. (1987). *The creative edge: Fostering innovation where you work.* Reading, MA: Addison-Wesley.

National Council for Accreditation of Teacher Education. (1987). *Standards, procedures, and policies for the accreditation of professional education units.* Washington, DC: Author.

Pelz, D. C. (1981). *'Staging' effects in adoption of urban innovations.* Paper presented at the Evaluation Research Society, Austin, TX.

Popham, W. J. (1975). *Educational evaluation.* Englewood Cliffs, NJ: Prentice-Hall.

Provus, M. (1971). *Discrepancy evaluation for education program improvement and assessment.* Berkeley, CA: McCutchan.

Rogers, E. M. (1983). *Diffusion of innovation.* New York: Free Press.

Roth, R. A. (1978). *Handbook for evaluation of academic programs: Teacher education as a model.* Washington, D.C.: University Press of America.

Sarason, B. F. (1971). *The culture of the school and the problem of change.* Boston: Allyn and Bacon.

Stufflebeam, D. L. (1983). The CIPP Model for program evaluation. In G. F. Madaus, M. S. Scriven, and D. L. Stufflebeam (Eds.) *Evaluation models: Viewpoints on educational and human service evaluation* (pp.117-142). Boston: Kluwer-Nijhoff.

Stufflebeam, D. L., & Shrinkfield, A. J. (1985). *Systematic evaluation: A self-instructional guide to theory and practice.* Boston: Kluwer-Nijhoff.

Stufflebeam, D. L., & Webster, W. J. (1980). An analysis of alternative approaches to evaluation. *Educational Evaluation and Policy Analysis, 2*(3), 5-19.

Stufflebeam, D. L, Foley, W. J., Gephart, W. J., Guba, E. G., Hammond, R. L., Merriman, H. O., & Provus, M. M. (1971). *Educational evaluation and decision making.* Itasca, IL: F. E. Peacock.

Appendix A

Letter to ITEA and CTTE Officers Soliciting Nominations to the Panel

November 22, 1989

Dear

The Council on Technology Teacher Education has recently awarded me a small grant to assess the effectiveness of the change to technology teacher education as that change is implemented. The research design and procedures developed under the grant will be available for departmental faculties to use in evaluating the effectiveness of change in their own institutional settings. In addition, the research design and procedures should be useful in comparative studies of the effectiveness of the change to technology teacher education across institutional boundaries.

A modified Delphi design is being used in the development of the research instruments. A panel of 20 leading practitioners and advocates in technology teacher education will be asked to suggest ways in which technology teacher education programs should be assessed. Nominations of individuals to serve as Delphi panelists are being sought from officers of CTTE and ITEA, in accordance with the procedures outlined in the proposal.

Please list on the enclosed form at least 10 individuals who could assist the project in identifying criteria and procedures for assessing the effectiveness of the change to technology teacher education programs? A return envelope is enclosed. It is perfectly appropriate to list yourself as one of the possible resource persons.

Thanks for taking time to assist in this first phase of the research.

Sincerely,

Daniel L. Householder
Professor and Project Director

Appendix B

Listing of Panelists

Dr. Lowell D. Anderson
Department of Industrial Technology Education
School of Technology
Indiana State University
Terre Haute, IN 47809

Dr. Myron Bender
Department of Industrial Technology
College of Human Resource Development
University of North Dakota
Grand Forks, ND 58202

Dr. Roger M. Betts
Department of Industrial Technology
College of Natural Science
University of Northern Iowa
Cedar Falls, IA 50614-0178

Dr. William E. Dugger
Technology Education Program Area
Vocational-Technical Education
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061-0432

Dr. Thomas L. Erekson
Industrial, Technological and Occupational Education
College of Education
University of Maryland
College Park, MD 20742

Dr. Everett N. Israel
Department of Industrial Technology
College of Technology
Eastern Michigan University
Ypsilanti, MI 48197

Dr. Donald P. Lauda
Applied Arts and Sciences
California State University
Long Beach, CA 90840

Dr. Franzie L. Loepp
Illinois State University
Department of Industrial Technology
College of Applied Science and Technology
Normal, IL 61761

Dr. G. Eugene Martin
School of Applied Arts & Technology
Southwest Texas State University
San Marcos, TX 78666

Dr. David L. McCrory
Technology Education Program
College of Human Resources and Education
West Virginia University
Morgantown, WV 26506-6122

Dr. Douglas L. Polette
Technology Education, Cheever Hall
College of Agriculture
Montana State University
Bozeman, MT 59717

Dr. John M. Ritz
Occupational and Technical Studies Department
College of Education
Old Dominion University
Norfolk, VA 23529

Dr. James H. Rokusek
Department of Business and Industrial Education
College of Technology
Eastern Michigan University
Ypsilanti, MI 48197

Dr. Ernest N. Savage
College of Technology
Bowling Green State University
Bowling Green, OH 43403

Dr. Anthony E. Schwaller
Department of Industrial Studies
Headley Hall
College of Science and Technology
St. Cloud State University
St. Cloud, MN 56301

Dr. Donald F. Smith
Department of Industry and Technology
College of Applied Sciences and Technology
Ball State University
Muncie, IN 47306

Dr. Kendall N. Starkweather
International Technology Education
Association
1914 Association Drive
Reston, VA 22091

Dr. Leonard F. Sterry
School of Industry and Technology
University of Wisconsin-Stout
1102 Union Street
Menomonie, WI 54751

Dr. Ronald Tuttle
School of Business and Technology
Kearney State College
Kearney, NE 68849

Dr. A. Emerson Wiens
Department of Industrial Technology
College of Applied Science and
Technology
Illinois State University
Normal, IL 61761

Dr. John R. Wright
School of Technology
Central Connecticut State University
1615 Stanley Street
New Britain, CT 06050

Dr. R. Thomas Wright
Department of Industry and
Technology
College of Applied Sciences and
Technology
Ball State University
Muncie, IN 47306

Appendix C

Round I Letter and Open Ended Questionnaire to Panelists

December 18, 1989

Dear Panelist:

The Council on Technology Teacher Education has recently awarded me a small grant to assess the effectiveness of the change to technology teacher education as that change is implemented. The research design and procedures developed under the grant will be available for departmental faculties to use in evaluating the effectiveness of change in their own institutional settings. In addition, the research design and procedures should be useful in comparative studies of the effectiveness of the change to technology teacher education across institutional boundaries.

A modified Delphi design is being used in the development of the research instruments. You have been nominated to serve on a panel of 22 leading practitioners and advocates in technology teacher education who are being asked to suggest ways in which the effectiveness of the change from industrial arts teacher education to technology teacher education programs should be assessed.

Please list on the enclosed form at least five criteria and at least three procedures for assessing the effectiveness of the change to technology teacher education programs. A return envelope is enclosed to facilitate your response.

Thanks for your participation in this phase of the research. As soon as the results of this round are compiled, you will be asked to prioritize the criteria and procedures as the next step in the development of the evaluation process. Your CTTE colleagues -- and their students -- will benefit from your contributions to this effort.

Sincerely,

Daniel L. Householder
Professor and Project Director

Round I Open Ended Questionnaire

Criteria for evaluating the effectiveness of the change from industrial arts teacher education to technology teacher education programs:

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

Procedures for evaluating the effectiveness of the change from industrial arts teacher education to technology teacher education programs:

1.

2.

3.

4.

5.

Appendix D

Round II Letter and Questionnaire to Panelists

January 31, 1990

Dear Panelist:

Thanks for your assistance as a member of the panel in our Council on Technology Teacher Education project, "The Development and Pilot Testing of a Research Design for Evaluating the Effectiveness of Change to NCATE/CTTE/ITEA Curriculum Guidelines in Technology Teacher Education."

During the first round of the Delphi study, panelists suggested criteria and procedures for assessing the effectiveness of program change from industrial arts teacher education to technology teacher education. These have now been tabulated, reviewed, and edited to create the enclosed lists. The next task in the research is to identify the most important criteria and the most promising procedures.

Please review the list of criteria and edit each of them as you see fit. Evaluate the importance of each criterion by circling a number on the 0-10 scale. Then, repeat this process with the list of procedures. A return envelope is enclosed for your response.

Thanks again for your continued participation in the research. Your CTTE colleagues -- and their students -- will benefit from your contributions to this effort.

Sincerely,

Daniel L. Householder
Professor and Project Director

Round II Questionnaire

CRITERIA

Technology teacher education (TTE) is the (usually) undergraduate program that prepares specialized teachers who are capable of organizing and implementing contemporary programs of technology education (TE) in the elementary and secondary schools.

In order to evaluate the effectiveness of the change from industrial arts teacher education to technology teacher education several criteria must be employed. The criteria listed below were identified during the first round of correspondence with the panel members.

Please rate the importance of each criterion by circling a number on the 0 to 10 scale. (You may edit the criterion if you wish.) A rating of 0 is a recommendation that the criterion be dropped. A rating of 10 implies that the criterion is absolutely vital to the assessment of the effectiveness of the change to technology teacher education.

If a criterion should be added, please write it in the space provided on page 5, indicate the category where it should be added, and rate it.

Technology Teacher Education Program

0..1..2..3..4..5..6..7..8..9..10 Courses cover the spectrum of technology education.

0..1..2..3..4..5..6..7..8..9..10 General education requirements in mathematics, science, computer science, and humanities provide the necessary breadth and depth.

0..1..2..3..4..5..6..7..8..9..10 Problem solving and decision making abilities are emphasized.

0..1..2..3..4..5..6..7..8..9..10 Laboratory instruction provides opportunities for students to reinforce abstract concepts with concrete experiences.

0..1..2..3..4..5..6..7..8..9..10 Instruction emphasizes the safe and efficient use of tools, machines, and equipment.

0..1..2..3..4..5..6..7..8..9..10 Teacher preparation is the primary programmatic focus.

0..1..2..3..4..5..6..7..8..9..10 Curriculum is in compliance with ITEA/CTTE/NCATE guidelines.

0..1..2..3..4..5..6..7..8..9..10 Philosophy, mission statement, goals and curriculum emphasize technological skills as opposed to technical skills.

Program Criteria - Continued

0..1..2..3..4..5..6..7..8..9..10 Cutting edge technologies are included in instructional offerings.

0..1..2..3..4..5..6..7..8..9..10 Professional studies component emphasizes the study of technology, including social-cultural affects and consequences.

0..1..2..3..4..5..6..7..8..9..10 Library acquisitions reflect contemporary technology.

0..1..2..3..4..5..6..7..8..9..10 Textbooks and instructional media reflect contemporary technology.

0..1..2..3..4..5..6..7..8..9..10 Field experiences are technology-centered.

0..1..2..3..4..5..6..7..8..9..10 Instruction incorporates current technological activities.

0..1..2..3..4..5..6..7..8..9..10 Content is organized around technological systems.

0..1..2..3..4..5..6..7..8..9..10 Technology, as a body of knowledge, determines program goals and structure.

0..1..2..3..4..5..6..7..8..9..10 Social-cultural impacts of technology are emphasized.

0..1..2..3..4..5..6..7..8..9..10 Instructional strategies emphasize conceptual understanding and problem solving.

0..1..2..3..4..5..6..7..8..9..10 Curricula are based on recent research findings.

0..1..2..3..4..5..6..7..8..9..10 Facilities represent contemporary technologies.

0..1..2..3..4..5..6..7..8..9..10 Laboratories facilitate the learning of broad based technological concepts.

0..1..2..3..4..5..6..7..8..9..10 Administrators in the institution agree with and support the philosophical change to technology teacher education.

0..1..2..3..4..5..6..7..8..9..10 Financial support for technology teacher education is adequate.

Program Criteria - Continued

0..1..2..3..4..5..6..7..8..9..10 Program is recognized as technology teacher education by faculty within the institution, colleagues in other institutions, and public school administrators.

Faculty Members

0..1..2..3..4..5..6..7..8..9..10 Participate in planned professional development activities to update their knowledge and skills.

0..1..2..3..4..5..6..7..8..9..10 Are actively engaged in research in technology education.

0..1..2..3..4..5..6..7..8..9..10 Publish in the field of technology education.

0..1..2..3..4..5..6..7..8..9..10 Present at national, regional, and local conferences.

0..1..2..3..4..5..6..7..8..9..10 Display a positive attitude toward the technology teacher education curriculum.

0..1..2..3..4..5..6..7..8..9..10 Communicate their understanding of the meaning and implications of technology education both within and outside the classroom.

Students are expected to:

0..1..2..3..4..5..6..7..8..9..10 Identify the concepts, principles, and systems of technology.

0..1..2..3..4..5..6..7..8..9..10 Effectively plan and implement technology education in grades 5-12.

0..1..2..3..4..5..6..7..8..9..10 Apply current instructional theory.

0..1..2..3..4..5..6..7..8..9..10 Demonstrate knowledge of current technology.

0..1..2..3..4..5..6..7..8..9..10 Formulate appropriate objectives.

0..1..2..3..4..5..6..7..8..9..10 Develop or use a new or existing taxonomy.

0..1..2..3..4..5..6..7..8..9..10 Plan and implement teaching-learning activities.

Student Criteria - Continued

0..1..2..3..4..5..6..7..8..9..10 Design evaluation devices and instruments.

0..1..2..3..4..5..6..7..8..9..10 Demonstrate a basic understanding of tools, machines and process and their applications in manufacturing, construction, communication, and transportation.

0..1..2..3..4..5..6..7..8..9..10 Develop and implement curriculum material that reflect a broad technological system area.

0..1..2..3..4..5..6..7..8..9..10 Develop a curriculum that illustrates how new technology is created.

0..1..2..3..4..5..6..7..8..9..10 Develop a curriculum that analyzes the social-cultural affects of technology.

0..1..2..3..4..5..6..7..8..9..10 Demonstrate the ability to teach problem solving techniques.

0..1..2..3..4..5..6..7..8..9..10 Demonstrate an awareness of society's reliance on technological systems.

0..1..2..3..4..5..6..7..8..9..10 Develop conceptual understandings.

0..1..2..3..4..5..6..7..8..9..10 Be process oriented.

0..1..2..3..4..5..6..7..8..9..10 Be open to change and willing to initiate change.

0..1..2..3..4..5..6..7..8..9..10 Be people oriented.

0..1..2..3..4..5..6..7..8..9..10 Be future oriented.

0..1..2..3..4..5..6..7..8..9..10 Consider global perspectives in technology education.

0..1..2..3..4..5..6..7..8..9..10 Use a vocabulary that reflects the concepts of technology education.

0..1..2..3..4..5..6..7..8..9..10 Have a personal professional development plan.

Graduates of the Technology Teacher Education Program

0..1..2..3..4..5..6..7..8..9..10 Teach concepts and use teaching techniques that are technology based.

0..1..2..3..4..5..6..7..8..9..10 Employ a philosophy which reflects a technological base.

0..1..2. 3..4..5..6..7..8..9..10 Recommend the purchase of appropriate equipment.

0..1..2..3..4..5..6..7..8..9..10 Implement technology based activities.

0..1..2..3..4..5..6..7..8..9..10 Use group activities in their instruction.

0..1..2..3..4..5..6..7..8..9..10 Encourage interdisciplinary approaches.

0..1..2..3..4..5..6..7..8..9..10 Receive preferred status from prospective employers.

Other Criteria (Please indicate the category)

0..1..2..3..4..5..6..7..8..9..10

0..1..2..3..4..5..6..7..8..9..10

0..1..2..3..4..5..6..7..8..9..10

PROCEDURES

Please rate the importance of each procedure by circling a number on the 0 to 10 scale. (You may edit the procedure if you wish.) A rating of 0 is a recommendation that the procedure be dropped. A rating of 10 indicates that the procedure is absolutely vital to the assessment of the effectiveness of the change to technology teacher education.

If a procedure should be added, please write it in the space provided -- and rate it.

* *

0..1..2..3..4..5..6..7..8..9..10 Use paper and pencil tests to determine whether the students have learned the conceptual structure, principles, and systems of technology education.

0..1..2..3..4..5..6..7..8..9..10 Observe seniors to assess their competence in teaching technology education.

0..1..2..3..4..5..6..7..8..9..10 Develop an exit examination to test outcomes of technology education teacher education.

0..1..2..3..4..5..6..7..8..9..10 Verify compliance with ITEA/CTTE/NCATE guidelines.

0..1..2..3..4..5..6..7..8..9..10 Develop and validate national standards for technology teacher education.

0..1..2..3..4..5..6..7..8..9..10 Determine whether the number of students in the program represents a viable part of the department's program offerings.

0..1..2..3..4..5..6..7..8..9..10 Analyze the courses required in the program, the content contained in each of the courses, teaching strategies and methods, assignments, tests, and student field experience to determine if they reflect technology education.

0..1..2..3..4..5..6..7..8..9..10 Interview students to assess their belief in life-long learning.

0..1..2..3..4..5..6..7..8..9..10 Interview students to assess the degree to which they are people oriented.

0..1..2..3..4..5..6..7..8..9..10 Verify records of professional development activities of faculty

Procedures - Continued

0..1..2..3..4..5..6..7..8..9..10 Review the content and quality of faculty research and publications.

0..1..2..3..4..5..6..7..8..9..10 Examine assignments and laboratory activities to determine the extent of problem solving, concept applications, and tool, machine and equipment utilization.

0..1..2..3..4..5..6..7..8..9..10 Examine assignments and laboratory activities to determine whether they reflect current education theory, current technology, and a future orientation.

0..1..2..3..4..5..6..7..8..9..10 Obtain data regarding hiring of graduates because of their technology education knowledge from program faculty who act as hiring contacts and/or university placement offices.

0..1..2..3..4..5..6..7..8..9..10 Poll public school administrators regarding their hiring preference for graduates of the program.

0..1..2..3..4..5..6..7..8..9..10 During on-site inspections, verify that facility changes reflect technology education requirements.

0..1..2..3..4..5..6..7..8..9..10 Poll students and colleagues within the institution and outside of the institution to see if the program is regarded as technology education.

0..1..2..3..4..5..6..7..8..9..10 Listen in the halls to learn whether the students and faculty speak a language indicative of an understanding of the change to technology education.

0..1..2..3..4..5..6..7..8..9..10 Examine course descriptions to determine whether they reflect the terminology of technology education.

0..1..2..3..4..5..6..7..8..9..10 Observe student activities, projects, and products to determine if they reflect technology education.

0..1..2..3..4..5..6..7..8..9..10 Survey students to assess their understanding of the social-cultural aspects of technology.

0..1..2..3..4..5..6..7..8..9..10 Determine whether faculty members are reading and talking about technology.

0..1..2..3..4..5..6..7..8..9..10 Determine the level of student and faculty enthusiasm about the technology teacher education curriculum.

Procedures - Continued

0..1..2..3..4..5..6..7..8..9..10 Review the adequacy of faculty and staff allocations to the program.

0..1..2..3..4..5..6..7..8..9..10 Examine the curriculum to determine if the philosophy, definition, mission statement, goals and objectives, course content, and learning experience reflect technology education.

0..1..2..3..4..5..6..7..8..9..10 Follow up the graduates to determine what concepts and activities they are teaching, and the teaching techniques they are using.

0..1..2..3..4..5..6..7..8..9..10 Query recent graduates for their opinions on the philosophy and purpose of technology education.

0..1..2..3..4..5..6..7..8..9..10 Conduct a self study of the program in conjunction with an external review.

0..1..2..3..4..5..6..7..8..9..10 Examine trends in institutional financial support of technology teacher education.

0..1..2..3..4..5..6..7..8..9..10 Review reading lists of books and periodicals provided to students by faculty.

0..1..2..3..4..5..6..7..8..9..10 Examine enrollment trends.

0..1..2..3..4..5..6..7..8..9..10 Review faculty qualifications and inservice development efforts.

0..1..2..3..4..5..6..7..8..9..10 Evaluate the pacing and time frame of the change to technology teacher education.

Other Procedures

0..1..2..3..4..5..6..7..8..9..10

0..1..2..3..4..5..6..7..8..9..10

0..1..2..3..4..5..6..7..8..9..10

Comments:

Appendix E

Ranked Listing of Criteria and Procedure Statements Sorted by Questionnaire Category.

Mean *	Technology Teacher Education Program
9.55	Laboratory instruction provides opportunities for students to reinforce abstract concepts with concrete experiences.
9.50	Instructional strategies emphasize conceptual understanding and problem solving.
9.23	Professional studies component emphasizes the study of technology, including social-cultural affects and consequences.
9.22	Laboratories facilitate the learning of broad based technological concepts.
9.22	Instruction incorporates current technological activities.
9.17	Philosophy, mission statement, goals and curriculum emphasize technological skills as opposed to technical skills.
9.17	Social-cultural impacts of technology are emphasized.
9.12	Field experiences are technology centered.
9.05	Problem solving and decision making abilities are emphasized.
9.00	Curricula are based on recent research findings.
8.89	Program is recognized as technology teacher education by faculty within the institution, colleagues in other institutions, and public school administrators.
8.89	General education requirements in mathematics, science, computer science, and humanities provide the necessary breadth and depth.
8.78	Library acquisitions reflect contemporary technology.
8.67	Administrators in the institution agree with and support the philosophical change to technology teacher education.
8.67	Financial support for technology teacher education is adequate.
8.67	Courses cover the spectrum of technology education.
8.50	Textbooks and instructional media reflect contemporary technology.
8.29	Technology as a body of knowledge, determines program goals and structure.
8.28	Cutting edge technologies are included in instructional offerings.
8.22	Facilities represent contemporary technologies.
8.22	Instruction emphasizes the safe and efficient use of tools, machines, and equipment.

Technology teacher education program - Continued

7.89 Curriculum is in compliance with ITEA/CTTE/NCATE guidelines.

7.78 Content is organized around technological systems.

6.39 Teacher preparation is the primary focus.

Faculty Members

9.50 Display a positive attitude toward the technology teacher education curriculum.

9.22 Participate in planned professional development activities to update their knowledge and skills.

9.05 Communicate their understanding of the meaning and implications of technology education both within and outside the classroom.

7.78 Are actively engaged in research in technology education.

7.78 Publish in the field of technology education.

7.72 Present at national, regional, and local conferences.

Students Are Expected To:

9.78 Be people oriented.

9.44 Be future oriented.

9.39 Demonstrate the ability to teach problem solving techniques.

9.33 Effectively plan and implement technology education in grades 5-12.

9.28 Develop and implement curriculum material that reflect a broad technological system area.

9.28 Demonstrate an awareness of societies reliance on technological systems.

9.22 Plan and implement teaching-learning activities.

9.17 Use a vocabulary that reflects the concepts of technology education.

9.11 Apply current instructional theory.

9.06 Formulate appropriate objectives.

9.05 Be open to change and willing to initiate change.

9.05 Consider global perspectives in technology education.

9.00 Demonstrate a basic understanding of tools, machines and process and their applications in manufacturing, construction, communication, and transportation.

8.94 Demonstrate knowledge of current technology.

8.83 Develop conceptual understandings.

Students - Continued

8.78 Develop a curriculum that analyzes the social-cultural affects of technology.

8.55 Design evaluation devices and instruments.

8.50 Be process oriented.

8.39 Have a personal professional development plan.

8.00 Develop a curriculum that illustrates how new technology is created.

7.67 Develop or use a new or existing taxonomy.

7.50 Identify the concepts, principles, and systems of technology.

Panelist Write-ins:

0.55 Revise existing courses and develop new courses to reflect contemporary technology education content and methods.

0.55 Use group activities and individual activities in their instruction.

0.55 Implement new and revised courses.

Graduates of the Technology Teacher Education Program:

9.78 Employ a philosophy which reflects a technological base.

9.61 Teach concepts and use teaching techniques that are technology based.

8.83 Implement technology based activities.

8.78 Use group activities in their instruction.

8.72 Encourage interdisciplinary approaches.

8.10 Recommend the purchase of appropriate equipment.

6.67 Receive preferred status from prospective employers.

Procedure Statements

9.50 Examine the curriculum to determine if the philosophy, definition, mission statement, goals and objectives, course content, and learning experience reflect technology education.

9.22 Analyze the courses required in the program, the content contained in each of the courses, teaching strategies and methods, assignments, tests, and student field experience to determine if they reflect technology education.

8.72 Validate the impact of ITEA/CTTE/NCATE national standards for technology teacher education upon the change process.

8.50 Verify compliance with ITEA/CTTE/NCATE guidelines.

8.44 Follow up the graduates to determine what concepts and activities they are teaching, and the teaching techniques they are using.

Procedures - Continued

8.39 Observe student activities, projects, and products to determine if they reflect technology education.

8.33 Examine assignments and laboratory activities to determine whether they reflect current education theory, current technology, and a future orientation.

8.33 Observe students in the final year of the program to assess their competence in teaching technology education.

8.22 Query recent graduates for their opinions on the philosophy and purpose of technology education.

8.11 Develop an exit examination to test outcomes of technology education teacher education.

8.05 Survey students to assess their understanding of the social-cultural aspects of technology.

8.00 Conduct a self study in conjunction with an external review.

7.89 Review faculty qualifications and inservice development efforts.

7.83 Examine assignments and laboratory activities to determine the extent of problem solving, concept applications, and tool, machine and equipment utilization.

7.44 Review reading lists of books, periodicals, magazines, newspapers provided to students by faculty.

7.44 Examine course descriptions to determine whether they reflect the terminology of technology education.

7.33 Examine trends in institutional financial support of technology teacher education.

7.28 During on-site inspections, verify that facility changes reflect technology education requirements.

7.22 Students and faculty are enthusiastic about the technology education curriculum.

7.16 Evaluate the pacing and time frame of the change to technology teacher education.

7.11 Determine whether faculty members are reading and talking about technology.

7.05 Verify records of professional development activities of faculty.

6.89 Obtain data regarding hiring of graduates because of their technology education.

6.78 Review the adequacy of faculty and staff allocations to the program.

6.78 Verify faculty research and writing.

Procedures - Continued

6.61 Examine enrollment trends and recruitment procedures.

6.44 Interview students to assess the degree to which they are people oriented.

6.28. Use paper and pencil tests to determine whether the students have learned the conceptual structure, principles, and systems of technology education.

6.05 Poll public school administrators regarding the hiring preference for program graduates.

6.05 Interview students to assess their belief in life-long learning.

6.00 Poll students and colleagues within the institution and outside of the institution to see if the program is regarded as technology education.

4.39 Listen in the halls to learn whether the students and faculty speak a language indicative of an understanding of the change to technology education.

Panelist Write-ins:

0.55 Review portfolios of student work.

* Rated for importance on a 0 to 10 scale with 0 meaning delete from procedure list and 10 meaning absolutely essential.

Appendix F

Panel Responses Compared with NCATE-Guidelines and Evidence of Compliance

The table below lists the criteria suggested by the panel of experts in this study and the NCATE curriculum guideline(s) most closely associated with the respective suggested criteria. The criteria are presented in the order that they appeared on the Round II questionnaire and are not ranked in any way. Beside each criterion or set of criteria, procedures suggested by the panel and evidence requested to establish compliance with the NCATE curriculum guidelines are noted.

For Clarity:

The criteria and procedures identified by the panel in this research are presented in italics.

The NCATE-guidelines and corresponding evidence of compliance are presented in normal typeface.

Technology Teacher Education Program

Criteria/NCATE-Guideline(s)	*Procedures/Evidence of Compliance*
Courses provide a balanced coverage of the spectrum of technology education.	*Examine course descriptions to determine whether they reflect the terminology of technology education.*
NCATE #3.2 Instructional content is drawn from the following content organizers, 3.2.1 communication, 3.2.2 construction, 3.2.3 manufacturing, and 3.2.4 transportation.	**3.2.1,.2,.3,.4** For each of the four technology areas there is evidence of specific, required and well developed academic and laboratory courses and experiences that: - provide knowledge and understanding of technological system, concepts, and technical means. - develop within each student the ability to perform in the several technical areas of the technological system using state-of-the-art instruments, devices, equipment and materials.
General education requirements in such areas as mathematics, science, computer science, social sciences, and humanities provide the necessary breadth and depth.	*No suggested procedure.*
NCATE #2.0 Courses in math, science, and related areas in the general education component provide the necessary depth and breadth for technology education.	**2.1** - Mathematics courses required of all students and taught by faculty fully qualified in mathematics. Courses are: (a) area appropriate, and (b) of the depth and quality to provide a solid foundation for continued mathematical development. In addition, the principles of mathematics are incorporated into all technology courses. **2.2** Same as **2.1** plus: Concepts and principles of the sciences are utilized in appropriate and meaningful applications in the analysis of technical problems and in the design of technological devices and systems. **2.3** Related areas of study (General Education) are a part of the required technology teacher education program.

Criteria/NCATE-Guideline(s)	Procedures/Evidence of Compliance
Problem solving and decision making abilities are emphasized.	*Examine assignments and laboratory activities to determine the extent of problem solving, concept applications, and tool, machine and equipment utilization.*
NCATE # 3.7 The program develops student problem-solving and decision making abilities involving human and material resources, processes and technological systems.	**3.7** document student work and written and other evaluations.
Laboratory instruction provides opportunities for students to reinforce technological concepts with concrete experiences.	*No suggested procedures.*
NCATE 3.8 The program provides activity oriented laboratory instruction with student reinforcing abstract concepts with concrete experiences.	**3.8** Course syllabi and photo records, video, or other graphic documentation, that students are involved in specific laboratory instruction that focuses on stated abstract concepts and that the program provides for the reinforcement of abstract concepts with concrete experiences.
Instruction emphasizes the safe and efficient use of a wide variety of tools, machines, and equipment.	*No suggested procedure.*
NCATE 3.5 The program assists students to apply tools, materials, machines, processes, and technical concepts, safely and efficiently.	**3.5** Logs of safety lessons taught and monitoring of student performance.
Curriculum is in compliance with ITEA/CTTE/NCATE guidelines.	*Verify compliance with ITEA/CTTE/NCATE guidelines.*
Philosophy, mission statement, goals and curriculum emphasize technological skills as opposed to technical skills.	*Examine the curriculum documents to determine if the philosophy, definition, mission statement, goals and objectives, course content, and learning experience reflect technology education.*
NCATE 1.1 The technology education program is based on a sound mission statement with stated goals and objectives which reflect the intent of technology education.	**1.1** Written mission statement, goals and objectives, that are compatible with: (a) contemporary philosophy, practice, and current research findings for curriculum design. AND (b) the definition and description of technology education as published by ITEA.

Criteria/NCATE-Guideline(s)	Procedures/Evidence of Compliance
Instruction incorporates current technological activities, cutting edge technologies, and provides for the exploration of new and emerging technologies.	*No suggested procedure.*
NCATE 3.11 The program develops in student the ability to apply technological knowledge and skills to understanding various past-present-future technology systems.	**3.11** Formal evaluation results that students develop positive and appropriate attitudes, and knowledge and skills in the use and analysis of information concerning the composition and operation of various past, present, and future technological systems.
Professional studies component emphasizes the study of technology, including social-cultural effects and consequences.	*Survey students to assess their understanding of the social-cultural aspects of technology.*
NCATE 3.1 The program is based on fundamental knowledge about the development of technology, its effect on people, the environment and culture; and industry, its organization, personnel systems, techniques, resources and products and their socio-cultural impacts.	**3.1** The core program includes academic courses and experiences, taught by qualified faculty, that provide fundamental knowledge and understanding of: - the history and evolution of technology and technological systems including inventions, innovations, developments, people, events, and places. - the study of technological development and its effect on people, cultures, and the environment. - industry, its organization, personnel systems, techniques, resources, and products. - industry and its social-cultural impact.
Library acquisitions reflect contemporary technology.	*No suggested procedure.*
Textbooks and instructional media reflect contemporary technology.	*Review reading lists of books, periodicals, magazines, newspapers provided to students by faculty.*
Professional field experiences are technology education.	*No suggested procedure.*
NCATE 6.0 The curriculum includes a full-time student teaching experience conducted in a technology education program under the supervision of program faculty and a master teacher in the school setting.	**6.0** Faculty vitae, faculty assignments, published policies, program requirements, master teacher qualifications, and technology education faculty qualifications, and transcripts of graduates, that each person has participated in a well structure, carefully monitored and supervised full-time student teaching experience. The program is administered and supervised by qualified technology education program faculty in cooperation with a certified master teacher in an approved technology education program laboratory and classroom setting.

Criteria/NCATE-Guideline(s)	***Procedures/Evidence of Compliance***
NCATE 6.0 continued.	**6.1** Student teaching assignments, weekly student teacher activity plans, reports from master teacher, on site visitation reports by supervisors, orientation programs and student teaching plans (a) in a public or private school setting, (b) a wide range of experiences were provided. **6.2** Student had full responsibility for the preparation, teaching and management of classes and laboratories.
Content is organized around technological systems. **NCATE 1.2** The program is based on an organized set of concepts, processes and systems that are uniquely technological.	*No suggested procedure.* **1.2** Evidence in course syllabi of a focus on: (a) specific technological concepts, principles and intellectual processes (b) relationship to other technological and social systems.
Technology, as a body of knowledge, determines program goals and structure. **NCATE 1.3** The study of technology is reflected in curricular design, course outlines, instructional strategies, and evaluation of student work.	*Analyze the courses required in the program, the content contained in each of the courses, teaching strategies and methods, assignments, tests, and student field experience to determine if they reflect technology education.* **1.3** Evidence that curriculum documents are compatible with: (a) brochures, admission policies, department activities such as conferences, minutes of meetings, etc. (b) course outlines (c) instructional strategies (d) student evaluation
Instructional strategies emphasize conceptual understanding and problem solving.	*No suggested procedure.*
Curricula are based on recent research findings. **NCATE 1.0** The technology education program provides a curriculum that is consistent with current research findings for curriculum design.	*Examine assignments and laboratory activities to determine whether they reflect current education theory, current technology, and a future orientation.* **1.1** Written mission statement, goals and objectives, that are compatible with: (a) contemporary philosophy, practice, and current research findings for curriculum design. (b) the definition and description of technology education as published by ITEA.

Criteria/NCATE-Guideline(s)	Procedures/Evidence of Compliance
Facilities represent contemporary technologies and facilitate the learning of broad based technological concepts.	*During on-site inspections, verify that facility changes reflect technology education requirements.*
Administrators in the institution agree with and support the philosophical change to technology teacher education.	*Review the adequacy of faculty and staff allocations to the program.*
Financial support for technology teacher education is adequate.	*Examine trends in institutional financial support of technology teacher education.*
Program is recognized as technology teacher education by faculty within the institution, colleagues in other institutions, and public school administrators.	*Poll students and colleagues within the institution and outside of the institution to see if the program is regarded as technology education.*
Faculty Members	
Participate in planned professional development activities to update their technological knowledge and skills.	*Review faculty qualifications and inservice development efforts.* *Verify records of professional development activities of faculty.*
Are actively engaged in research in technology education. *Publish in the field of technology education.* *Present at national, regional, and local conferences.*	*Verify faculty research and writing.*
Display a positive attitude toward the technology teacher education curriculum.	*No suggested procedure.*
Communicate their understanding of the meaning and implications of technology education both within and outside the classroom.	*Determine whether faculty members are reading and talking about technology.*
Student Outcomes	
Identify the concepts, principles, and systems of technology.	*Use paper and pencil tests to determine whether the students have learned the conceptual structure, principles, and systems of technology education*
NCATE 3.4 The program assists students in developing insight, understanding, and application of technological concepts, processes, and systems.	**3.4** Evidence from course syllabi, instructional design and methodology, and from results on evaluation instruments to measure . . . (a) attaining a high level of insight and understanding and (b) developing the ability to apply basic technological concepts.

Criteria/NCATE-Guideline(s)	Procedures/Evidence of Compliance
Effectively plan and implement technology education in grades K - 12.	*No suggested procedure.*
NCATE 4.1 Develop a strategic plan that includes a mission statement, rationale for change, goals and objectives, action steps, as well as program evaluation strategy.	**4.1** Documented evidence that senior level students attain knowledge and skills that enable them to develop strategic plans for technology education programs that include mission statements, rationale for change to technology education, appropriate goals and objectives related to the mission statement, action steps for implementing the plan and a program evaluation strategy.
Apply current instructional theory.	*Observe students in the final year of the program to assess their competence in teaching technology education.*
Develop or use a new or existing taxonomy.	*Develop an exit examination to test outcomes of technology education teacher education.*
Plan and implement teaching-learning activities.	
Design appropriate evaluation devices and instruments.	
Develop and implement curriculum material that reflect a broad technological area.	
NCATE 4.6 Develop lesson plans, organize materials and present psychomotor, affective, and cognitive instruction.	**4.6** Documented evidence in the form of photo records, samples of written student work, and faculty evaluations of student performance that students are capable of: (a) developing well structured quality lesson plans . . . (b) selecting appropriate instructional materials . . . (c, d, e) designing, developing, presenting, and evaluating instruction . . . in the psychomotor realm, affective realm, and cognitive realm . . .
Formulate appropriate objectives.	*No suggested procedure.*
NCATE 4.2 Select content based on goals and objectives within the four content organizers.	**4.2** A random sample of senior level students in each of the four content categories be able to develop a program that will (a) use the appropriate content, (b) be of professional quality and contain as a minimum, 1) a mission statement, 2) a rationale for change, 3) goals, 4) objectives, 5) action steps for implementation, and 6) a program evaluation strategy.

Criteria/NCATE-Guideline(s)	Procedures/Evidence of Compliance
Demonstrate a basic understanding of tools, machines and process and their applications in manufacturing, construction, communication, and transportation.	*Review portfolios of student work.* *Observe student activities, projects, and products to determine if they reflect technology education.*
NCATE 3.3 The level and scope of skills in the use of tools, instruments, and machines to be identified and incorporated into the programs.	**3.3** (See compliance for 3.2.1-4 b.) Specific, required and will developed academic and laboratory courses and experiences . . . [in each of the four content categories] that: (b) develop within each student the ability to perform in several technical areas . . .
Develop a curriculum that illustrates how new technology is created. *Develop a curriculum that analyzes the social-cultural affects of technology.* *Demonstrate the ability to teach problem solving techniques.*	*No suggested procedure.*
NCATE 4.3 Structure an educational environment in the classroom and laboratory to accommodate the instructional process.	**4.3** Students are involved in structuring an educational environment in a classroom and laboratory that is compatible with the requirements of the instructional processes required for a given field of technology.
Demonstrate knowledge of current technology. *Demonstrate an awareness of societies' reliance on technological systems.* *Develop conceptual understandings in technology and technology education.* *Be process oriented.* *Be open to change and willing to initiate change.* *Be people oriented.* *Be future oriented.*	*Interview students to assess the degree to which they are people oriented.* *Interview students to assess their belief in life-long learning.* *Listen in the halls to learn whether the students and faculty speak a language indicative of an understanding of the change to technology education.*
NCATE 3.10 The program develops students' attitudes, knowledge, and skills regarding how technological systems function.	**3.10** Evidence from evaluation and assessment instruments, samples of student work, documented instructional content and other activities of the level of knowledge and the type and level of skills attained by students regarding how technological systems function.

Criteria/NCATE-Guideline(s)	*Procedures/Evidence of Compliance*
Consider global perspectives in technology education.	*No suggested procedure.*
NCATE 5.3 The students are introduced to multicultural and global perspectives as they relate to the study of technology.	**5.3** Documented evidence from course syllabi, faculty lesson plans, textbooks, instructional materials, and evaluation instruments that all students are knowledgeable about various cultures and their past. They are able to discuss current contributions to the evolution of technical means and technical systems and the interrelation between and among cultures and nations with respect to the creation and use of technical means and adaptive systems. They understand the relation of technical means and systems to human society, other life forms and the environment.
Use a new vocabulary that reflects the concepts of technology education.	*Listen in the halls to learn whether the students and faculty speak a language indicative of an understanding of the change to technology education.*
Have a personal professional development plan.	Interview students to assess their belief in life-long learning.
NCATE 4.12 Establish a professional development plan for continued personal and professional growth.	**4.12** Prepared and recorded written material that each student . . . has a plan designed to provide direction for continued personal and professional growth.

Graduates of the Technology Teacher Education Program

Teach concepts and use teaching techniques that are technology based.	
Recommend the purchase of appropriate equipment.	
Implement technology based activities.Follow up the graduates to determine what concepts and activities they are teaching, and the teaching techniques they are using.	
Employ a philosophy which reflects a technological base.	*Query recent graduates for their opinions on the philosophy and purpose of technology education.*
Use group activities in their instruction.	*No suggested procedure.*
NCATE 4.4 Select appropriate instructional strategies for individual and group instruction, including safety instruction.	**4.4** Documented evidence, in the form of student work, that students are capable of designing and selecting appropriate instructional strategies for group or individual instruction . . .

Criteria/NCATE-Guideline(s)	Procedures/Evidence of Compliance
Encourage interdisciplinary approaches.	*No suggested procedure.*
NCATE 3.12 The program develops in students an understanding of the application of other areas of knowledge (math, science, history, etc.) to technology and the solution of human and social problems, including appropriate skill in use of tools and machines.	**3.12** Documented evidence in the form of course syllabi, photo records, student work, results of student evaluation and other data that students are able to utilize knowledge, information, and skills from other disciplines in the analysis of proposed technological solutions to human and social problems
Receive preferred status as technology education teachers from prospective employers.	*Poll public school administrators regarding the hiring preference for program graduates.* *Obtain data regarding hiring of graduates because of their technology education.*

Other Suggested Procedures

Validate the impact of ITEA/CTTE/NCATE national standards for technology teacher education upon the change process.

Conduct a self study in conjunction with an external review.

Evaluate the pacing and time frame of the change to technology teacher education.

Examine enrollment trends and recruitment procedures.

Appendix G

Round III Letter to Panelists and

Draft Technology Teacher Education Checklist

June 20, 1990

Dear Panelist:

Thank you for continuing to serve as a member of the panel in our project, "The Development and Pilot Testing of a Research Design for Evaluating the Effectiveness of Change to ITEA/CTTE/NCATE Curriculum Guidelines in Technology Teacher Education," which is being conducted under a grant from the Council on Technology Teacher Education.

As you will recall, during the first round, panelists suggested criteria and procedures for assessing the effectiveness of program change from industrial arts teacher education to technology teacher education. During the second round, panelists evaluated the importance of each criterion and each procedure. These responses provided the foundation for the preparation of the "Technology Teacher Education Checklist." The checklist, which attempts to focus upon the most fundamental questions in the assessment of a technology teacher education program, is now being sent to panelists for their comments. Field testing, using the Checklist as an assessment guide, will begin soon.

Please review the attached Technology Teacher Education Checklist and give me your reactions to it by writing your notes directly on the canary copy and returning it in the enclosed reply envelope. A copy of the report of the research to date is enclosed to provide you with as much background as you may find interesting or helpful.

Thanks again for your continued participation in the research. Your CTTE colleagues -- and their students -- will benefit from your contributions to this effort.

Sincerely,

Daniel L. Householder
Professor and Project Director

Draft Technology Teacher Education Checklist

A. Examine the catalog and a sample of curriculum documents to determine the degree to which:

1. The philosophy, mission statement, and goals and objectives reflect the ITEA definition of technology education.

2. Study is required in these technological systems: communication, construction, manufacturing, and transportation.

3. Courses in mathematics and science are required.

4. Full-time student teaching experience in a technology education setting is required.

5. Required reading lists reflect technology education.

B. Interview the department head to determine the degree to which:

1. Funding is adequate to support the current technology teacher education program.

2. Faculty and staff allocations are adequate to serve student enrollments in technology teacher education.

3. The written departmental plan for faculty professional development and technological updating is adequate to prepare them for contemporary technology teacher education.

4. Current faculty research activities are directed toward technology education. Ask for a sample of current research activities to review.

5. Enrollment is adequate, stable, or increasing relative to enrollments prior to the change to technology education.

6. The written departmental implementation plan for technology teacher education addresses the process of organizational change.

C. Interview faculty and review recent biodata information, faculty publications, copies of presentations, and manuscripts being considered for publication to verify whether:

1. Faculty are writing about and giving presentations in technology education.

2. Current faculty research activities are directed toward technology education.

D. Observe professional classes to determine the degree to which:

1. Instructional methods reflect an emphasis on problem solving and decision-making.

2. Instructional materials reflect technology education.

TTEC Draft - Continued

E. Inspect laboratory facilities to ascertain the degree to which:

1. Equipment is appropriate for providing students opportunities to understand the concepts and practices of contemporary technologies. Such indicators may include equipment for desk-top publishing, robotics, CNC milling, CAD, video production, materials testing, laser applications.

F. Interview students and examine student logs or other required student work to discern whether:

1. The problem solving process and decision-making rationale are incorporated into grading.

2. Environmental consequences and social-cultural effects of technology are reflected in student activities.

G. Interview dean, provost, or president to learn their perceptions of technology education.

H. Listen to conversations and discussions to discern the degree to which:

1. The terminology used by faculty and students reflects technology education?

2. Faculty and students appear to be enthusiastic about technology education?

Appendix H

Comments on the Draft Technology Teacher Education Checklist

A. **Comments:**
"Seems to be worded in the context of what external evaluators would do."

1. . . . objectives of the program reflect the . . .
   Comments:
   "I am sure there is a reason, but why emphasis on ITEA?"
   "Doesn't CTTE and other documents explain what TE is?"
   "[ITEA] What about state definitions?"

2. . . . communication, biotechnology, construction . .
   . . . required in technological systems such as communication . . .
   Comments:
   "Production, biotechnology?"
   "Checking for its degree of depth."
   "May be configured a different way (i.e., communication, production, transportation . . .)."
   "These are changing."

3. . . . and are prerequisites to a study of technology.
   . . . mathematics, social science, and the language arts are required. Courses in mathematics, science and other disciplines are required and reinforce technological concepts.
   Comments:
   "Computer science?"
   "At least 2 courses in each area."

4. Pre-student teaching experience . . .
   Comments:
   "Important that [the technology education setting] is not IA."
   "The student teaching must have a technology education component. If we place student teachers in a traditional IA program, they may not develop into a TE teacher without some TE component of their student teaching."

5. . . . reflect technology and technology education.
   Comments:
   "[Reading lists] in professional courses? Or in technical courses as well?"

SUGGESTED ADDITIONS:

"Learning activities or experiences are representative of technology education and reflect objectives of course(s)."
"The impacts of technology are studied."
"Social-cultural elements are included in addition to technical content."

B. **Comments:**
"Seems to be worded in the context of what external evaluators would do."
"Also, annual faculty reports should be available."
"Needs to be worded to reflect the change to technology teacher education."

1. **Comments:**
   "How is this different from our industrial arts program?"

2. **Comments:**
   "How is this different from our industrial arts program?"

TTEC Draft Comments - Continued

3. **Comments:**
"Good."

4. **Comments:**
"During the various stages of development this will vary a great deal--in fact, it may decline for several years during the change process."
"Good number of majors?"

5. **Comments:**
"Good."
"Is this necessary?"
"Continuing curriculum improvement?"

SUGGESTED ADDITIONS:

"Faculty are committed to the philosophy and objectives of technology education."
"Philosophical support is provided by the administration and faculty."
"The program has changed to a TE philosophy."

C. . . . for publication and service activities to verify whether:

1. . . . in technology and technology education.
. . . writing and giving presentations about technology education.
. . . writing scholarly papers about . . .

2. . . . technology education topics of issues.
. . . faculty research and service activities . . .
Comments:
"Good."

SUGGESTED ADDITIONS:

"Involvement in professional associations."
"Content reflects the philosophy of technology educators."

D. . . . professional and technical classes . . .
Comments:
"Also lab classes."

1. . . . emphasis on technological problem solving . . .
. . . problem solving and a process orientation.
Comments:
"Difficult, but of some limited value."

2. . . . reflect major elements of technology education (e.g., systems, environmental and societal impacts, use of technological devices, etc.). Instructional methods reflect a study of technology.
Comments:
"How? They should reflect contemporary technology. How might these be different from materials that reflect industrial arts or industrial technology? Are faculty continually developing and updating instructional materials to reflect changing technologies?"

TTEC Draft Comments - Continued

SUGGESTED ADDITIONS:

"Professional involvement of faculty and students in campus, state/province, national and international organizations that promote technical teaching."

E. . . . equipment for computers, desk-top publishing . . . laser applications, conveyers, wind tunnels, bar coding, "white collar space", processing tools and machines.
Comments:
"What about facilities to develop curriculum materials?"
"Biotech?"
"Simulators."
"[CNC milling] table-top or full-sized?"
"Critical."

SUGGESTED ADDITIONS:

"Teaching strategies used in classes."
"The facilities have been designed to support conceptual teaching, including individual and group problem-solving."

F. . . . student logs and assignments given by faculty . . .

1. **Comments:**
"Good."
"What are the results of student activities that represent their class work (projects vs. understanding)? How are the students evaluated in their lab classes?"
"Of some value."

2. **Comments:**
"Good."

SUGGESTED ADDITIONS:

"Technical content is supportive of the technology thrust."
"Learning experiences, assignments, etc. are appropriate to technology education."
"Technology is understood as a discipline."
"The elements of technology education are understood and integrated into their total philosophy of education."
"The systems and concepts of technology are studied."
"A TECA chapter exists and is active in supporting the TE curriculum."

G. . . . their perceptions and support of . . .
. . . technology education, present and future.
Comments:
"For what purpose? Once we know their perceptions, then what?"
"How about department heads in related departments within the college?"
"Limited value, depending upon organization."

H. . . . discussions and observe student activity to . . .
Comments:
"Follow-up of graduates?"
"Hard to effectively measure."

TTEC Draft Comments - Continued

1. . . . reflects technology and technology education.

2. Faculty and students appear . . .
   Comments:
   "Good."

SUGGESTED ADDITIONS:

"Projects and activities are oriented toward the study of technology."

I. **SUGGESTED ADDITIONS:**

Review library holdings to ascertain if the holdings are adequate in Technology Education to support student and faculty research.

J. **SUGGESTED ADDITIONS:**

Interview consumers (i.e., principals) to ascertain if the graduates can implement technology education."

GENERAL COMMENTS

"Should you have anything pertaining to a person with a non-traditional background coming into the field since that very likely will happen more in the future?"

"To be used in 'self'-assessment by dept. faculty? Also to be used for external review 1-2 years prior to NCATE?"

"This looks excellent."

"Would it be appropriate to interview or visit critic teachers in technology education to determine whether they are in fact teaching technology education? I suspect this might also be ascertained in [item] F above."

"Good checklist."

"Do we have an adequate research base to now say that technology education is significantly better? I would appreciate copies of such research."

"Criteria do not seem to reflect the items on the checklist."

END

U.S. Dept. of Education

Office of Education
Research and
Improvement (OERI)

ERIC

Date Filmed

March 21,1991